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ABSTRACT

To determine the extent of awareness and use of the metric system among occupational education teachers and students, the New York State Bureau of Occupational Education sent questionnaires to relevant personnel in selected schools throughout the state. Responses were received from 344 teachers in 55 secondary schools and 42 post-secondary institutions. Only 19.4 percent of the secondary teachers surveyed indicated that their students regularly use the metric system; they were health education teachers or training and industrial teachers. Approximately 60 percent of the secondary teachers responding reported that they tried to stimulate awareness of the metric system among their students. More than 70 percent expressed the need or desire to participate in workshops concerning the metric system, but most reported that such workshops were unavailable, and that the primary stimuli for metric work in the classroom came from professional organizations. The data collected from post-secondary teachers supported these points of view. On the basis of these findings, it was recommended that the State Education Department develop hands-on inservice workshops concerned with the teaching of the metric system in occupational education courses and conduct such workshops throughout the state. (SD)

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NEW YORK EDUCATORS AND THE METRIC SYSTEM:

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A Survey of Selected Secondary and Post-Secondary Teachers' Usage, Needs, and Feelings Regarding Metric Measurement

The University of the State of New York

THE STATE EDUCATION DEPARTMENT

Bureau of Occupational Education Research

Albany, New York

October 1974

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ABSTRACT

During the past several years Congress has attempted to enact legislation that would establish the metric standard as the primary system of weights and measures in this country. Many industries and school systems have voluntarily initiated a change to metrics. An assessment of the present use of the metric system in selected New York State schools by occupational education teachers was the impetus for the present study.

Occupational education teachers from 52 BOCES, six city school districts, and 59 two-year post-secondary schools were contacted via questionnaire. A total of 344 teachers responded: 231 from 55 secondary schools and 113 from 42 post-secondary institutions.

Only 18 percent of the secondary and 55 percent of the post-secondary occupational education teachers noted that their students use metrics routinely in class or laboratory. However, the majority of teachers whose students do not routinely use metrics stated that an attempt to stimulate an awareness of the metric concept is made through the use of visual aides. Both groups of teachers indicated that the primary source of influence to stimulate student understanding of the metric system was generated by related professional organizations.

Fifteen of the high school teachers and two of the post-secondary teachers reported that metric measurement workshops had been held at their schools. A need or desire to participate in a metric workshop was expressed by approximately three-quarters of the high school teachers and one-half of the post-secondary teachers.

Approximately two-thirds of all the teachers surveyed believe that emphasis now needs to be placed on teaching the metric system in their particular discipline. Many of the instructors requested metric resource information and specifically mentioned the need for "methods" and "application" type materials.

In view of the results indicating that a majority of New York State teachers stimulate awareness of the metric system but do not have students regularly using it in class and the need for information expressed by the teachers, it is suggested that Education Department personnel assume a leadership role in helping both teachers and students prepare to participate in a metric world. It is recommended that guidelines regarding metrication be established and endorsed by the Department; that metric measurement teaching techniques specific to the occupational areas be developed and disseminated to instructors through regionally conducted workshops. It is further suggested that the planning staff of the inservice workshop experiences include local resource people in order to establish pre- and post-workshop relationships at the community level.

It is also recommended that Department personnel study the experimental metric projects presently being conducted in New York State and disseminate the findings through Department publications. Specific personnel should be assigned to study metric provisos in Federal legislation and publicize the affect this legislation may have on metric education in New York State.

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Introduction:

The metric system of measurement is used by over 90 percent of the nations of the world. In 1965 the British announced their move to metrics. In 1970 Australia and Canada announced plans for converting to the metric system (analysis noted in Engineering Journal, April 1973). At the present time only the following countries are not either on the metric system or converting to the metric system: Barbados, Burma, Gambia, Ghana, Liberia, Muscat and Oman, Nauru, Sierra Leone, Southern Yemen, Tonga, Trinidad, and the United States of America. The United States will be the last of the major nations to change to metric.

However, the United States has been moving toward the adoption of the metric system of weights and measures for over 100 years. An Act of Congress in 1866 "legalized" the use of the metric system; the 1875 Treaty of the Meter was signed by the United States; and since 1893, the metric standard has been basic to the fundamental weights and measures standards of the country.

Industry in the United States has already started to change to metric. The pharmaceutical and photographic industries have a big lead. A Department of Commerce study reports that 11 percent of the manufacturing companies surveyed use the metric system and 73 percent favor the metric system. Companies using the metric system, at least partially, include Allis-Chalmers Corporation, Beloit Tool Corporation, General Motors, Grumman Aerospace Corporation,Ford Motor Company, International Harvester Company and Sears. The Ohio Highway Department has decided to show both kilometers and miles on its interstate highway network.

Mr. Wilson Riles, State Superintendent of Public Instruction for

California, has announced that the metric system will be the primary measurement system taught in the California schools starting with the 1976-77 school year. The metric changes will be made with State Board of Education action and without action by the California state legislature. The Minnesota State Department of Education gave 31 in-service metric workshops for elementary teachers during the 1972-73 school year, metric units were introduced in the schools during 1973-74 and the in-service program will be expanded. The Maryland State Board of Education has announced the adoption of the metric system as the basic measurement system for the Maryland schools.

Purposes:

The primary purposes of this investigation were to assay the present employment of the metric system of weights and measures in New York State schools; to determine the extent of and the need for in-service teacher training programs, namely, workshops, in this area; and to note the sentiments of teachers regarding the need for metric emphasis in the particular disciplines.

Procedure:

Prior to the drafting of the survey instrument consultation regarding format and content was held with representatives from the Bureaus of Secondary Curriculum Development, Agricultural Education, Home Economics Education, Business Education, Distributive Education, Industrial Arts Education, Health Occupations Education, Trade and Technical Education and Mathematics Education. The initial instrument was tested for content

validity at a local BOCES. Suggested changes were made and the form was submitted to the State Education Department Forms Committee representative for final approval.*

Packets, each containing a letter of explanation, a questionnaire and a return-addressed envelope, were mailed to occupational education directors of each BOCES and six large city school districts. A covering letter to the directors requested them to distribute a packet to one teacher from each of the following areas: Distributive Education, Occupational Home Economics Education, Business Education, Agricultural Education, Health Occupations, and Trade and Industrial Education. A similar letter and adapted forms were mailed to the academic deans of the New York State community colleges.

The data submitted by the BOCES and community college instructors will be presented below in two separate sections. The ensuing discussion will combine both sets of reported data. Suggestions and recommendations will be presented in light of the commonality and uniqueness of responses specific to each group surveyed.

Secondary Sample:

Occupational education directors from 52 BOCES and six city school districts were mailed six packets to be distributed to representative members of their staff. Therefore, the potential response from occupational education teachers across the State was 348. However, 231 responses were received from representatives of 51 BOCES and four school districts. Thus, 96 percent of the BOCES and two-thirds of the city school districts contacted are represented in the tallies presented below. This means that 96.6 percent of all secondary schools contacted responded; 66 percent of the

* Questionnaire available from Bureau of Occupational Education Research, State Education Department, Albany, New York 12234

anticipated number of individual teacher responses were received.

In several instances, the instrument was duplicated by the school administrator and distributed to more than six teachers. All forms returned were considered useable unless the designation of curriculum speciality was omitted. Two such forms have been deleted from the study results and are not reflected in the figures previously mentioned or cited in Table I. Table I also lists location of the secondary schools where educators were contacted and the number responding to the questionnaire.

TABLE I

SECONDARY SCHOOLS WHERE EDUCATORS WERE CONTACTED
AND NUMBER RESPONDING TO QUESTIONNAIRE

I.D. #	NAME	#RESPONDING	I.D. #	NAME	#RESPONDING
1	Southeast Westchester	5	37	Jefferson	5
2	Westchester #2	4	38	Seaway Technical Center	3
3	Westchester #1	1	39	Delaware-Chenango	3
6	Orange and Ulster	4	40	Western Delaware	5
7	Rockland	3	41	Broome	3
9	Suffolk #3	2	42	Erie #2	12
10	Nassau	5	43	Genesee-Wyoming	3
11	Suffolk #2	4	44	Chautauqua	5
12	Suffolk #1	3	45	Orleans-Niagara	4
13	Hamilton-Fulton	4	47	Erie #1	6
14	Greene #2	5	48	Monroe	2
15	Rensselaer	3	49	Livingston	3
16	Albany-Schenectady	4	50	WI-MO-CO	6
18	Ulster	5	51	Wayne-Finger Lakes	4
19	Columbia-Greene	3	52	Wayne	6
20	Dutchess	4	54	Cattaraugus	4
21	Sullivan	4	55	Steuben-Allegany	5
22	Washington-Warren	3	56	Allegany Occupational Ctr.	2
23	Saratoga-Warren	5	57	Tompkins-Seneca	6
24	Clinton-Essex	6	58	Schuyler	4
25	Franklin-Essex	2	59	Orange Occupational Ctr.	0
26	Essex County	5			
27	Cayuga	3		CITY SCHOOL DISTRICTS	
28	Cortland-Madison	3	4	Yonkers	6
30	Oswego	5	8	Brooklyn	0
32	Onondaga-Madison	4	17	Albany	1
33	Lewis	5	31	Syracuse	4
34	Herkimer	5	46	Buffalo	2
35	Madison-Oneida	11	53	Rochester	3
36	Utica	4			

Each secondary teacher was requested to indicate (item #3) their particular occupational area of instruction. Ten of the respondents indicated more than one area; these are noted separately in Table 2.

TABLE 2

OCCUPATIONAL AREAS OF INSTRUCTION AS INDICATED BY INDIVIDUAL RESPONDENTS FROM SECONDARY SCHOOLS

Area	Number of Respondents	Percent of Total
a. Distributive Education	11	4.8
b. Home Economics Education	22	9.4
c. Business Education	26	11.3
d. Agricultural Education	28	12.1
e. Health Occupations Education	38	16.5
f. Trade and Industrial Education	78	33.9
g. Other	17	7.5
h. Combination of a and c	4	1.6
i. Combination of b and e	1	0.4
j. Combination of d and f	2	0.9
k. Combination of a and b	2	0.8
l. Combination of c and f	1	0.4
m. All areas checked	1	0.4
TOTAL	231	100.0

Results from Secondary Teachers:

When queried regarding the routine use of the metric system by students in classes or laboratories (item #4), 81.6 percent of the respondents said that their students did not regularly use the metric system. Of the 18.4 percent that responded in the affirmative, 47.6 percent (20) were health occupation educators and 38.1 percent (16) were trade and industrial teachers; the remaining teachers, 14.3 percent (6), were scattered across the occupational areas of instruction listed on the form.

Approximately 60 percent of the respondents indicated that they did" ... attempt to stimulate an awareness of the metric concept." Posters, bulletin board displays, dual dimensioning of drawings, interpretation of foreign car specs, recipe reading, temperature calculations, and the explanation of the monetary system are some of the methods employed by teachers to stimulate the understanding of the metric concept.

Of the 210 teachers responding to question, eight, 55.7 percent, reported that metric measurement workshops for teachers have not been considered at their schools; seven percent noted they have been held; 13.8 percent indicated that workshops are being planned. Listed in the "other" category, checked by 23 percent of the respondents, were comments such as "talked about, but not planned," "not aware of any plans" and "don't know."

Approximately 61 percent of the respondents reported that, as individual professionals, they felt that emphasis now needs to be placed on teaching the metric system in their particular instructional area. Another 18.6 percent do not feel this need; 9 percent expressed no opinion and 10 percent did not know how they felt. An overwhelming

majority of the respondents, 73.7 percent, indicated a need (or desire) to participate in a workshop concerning the metric system. Those who indicated no need were primarily engaged in teaching health or industrial arts.

Question #9 requested the teachers to rank the three most influential sources that have encouraged them to have their students "think metric." A list of eight items was presented; a ninth allowed for write-in information. Over 80 percent of the 218 respondents to this item did not follow directions, i.e., they did not indicate a rank. However, some broad generalizations may be made from the responses checked. Teachers seem to have been encouraged to stimulate student understanding of the metric system of measurement primarily by related professional organization publications, meetings, etc.; and secondly, by the public press. A large number of teachers reported no encouragement from any source. Several teachers, these were generally clustered by geographical location, noted that stimulation came from a local metric council.

Post-Secondary Sample:

Six copies of the survey instrument were mailed to each of the academic deans of 59 New York State two-year post-secondary schools. As with the secondary school administrators, the deans were requested to distribute the forms to their instructional staff in different areas of occupational education.

Table 3 includes the location of post-secondary schools where educators were contacted and the number responding to the questionnaire by occupational area. Responses were received from representatives of all but 15 of the institutions contacted. One school is closing and, of the 43 schools whose staff did respond, one institution had all three replies disqualified. Therefore, a total of 113 useable responses were obtained from 42 different post secondary schools.

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TABLE 3

LOCATION OF POST-SECONDARY SCHOOLS WHERE EDUCATORS WERE CONTACTED AND NUMBER RESPONDING TO QUESTIONNAIRE BY OCCUPATIONAL AREA

I.D. #	Name	Number of respondents by Occupational Area: Dist.Ed.	Home Ec.	Bus. Ed.	Agr. Ed.	Health Occ.	T & I. Ed.	D.E. & Bus.	Hlth.&T.I.	D. E.& H.E.	Total
1C	Fashion Inst. of Tech.						1				1
2C	Manhattan										0
3C	Voorhees-NYC						3				3
4C	Staten Island					1	1				2
5C	Hostos					2					2
6C	Bronx					1		1			2
7C	Concordia			1		1					2
8C	Rockland										0
9C	Harriman										0
10C	Orange					1	1				2
11C	Packer Collegiate Inst.										0
12C	Kingsborough			1		2		1			4 (1)
13C	Queensborough					1	1				2
14C	Academy of Aeronautics						2				2
15C	Nassau	1		1		1	1				4
16C	Farmingdale Ag. & Tech.										0
17C	Suffolk					1					1
18C	LaSalette Seminary										0
19C	Columbia-Greene			1				1			2
20C	Cobleskill Ag. & Tech.										0
21C	Fulton-Montgomery					1	2				3
22C	Hudson Valley		1				1				2 (1)
23C	Maria College-Albany			1		3					4
24C	Russell Sage Jr. Coll.							1			1 (1)
25C	Schenectady			1			2				3
26C	Ulster			1		1	2				4
27C	Bennett										0
28C	Dutchess				1	1					2 (2)
29C	Sullivan										0

( ) = additional responses disqualified

I.D. #	Name	Number of respondents by Occupational Area: Dist.Ed.	Home Ec.	Bus. Ed.	Agr. Ed.	Health Occ.	T & I. Ed.	D.E.& Bus.	Hlth.&T.I.	D.E.& H.E.	Total
30C	Adirondack						1				1 (2)
31C	Clinton			1		1					2
32C	Paul Smith										0 (3)
33C	North Country					1	1				2 (1)
34C	Westchester										0
35C	Auburn			1			1		1		3
36C	Cazenovia (closing)										0
37C	Tompkins-Cortland			1		1	1				3 (1)
38C	Maria Regina, Syracuse	1	2	1	1	1					6
39C	Onondaga					1					1 (1)
40C	Herkimer										0
41C	Mohawk Valley		1				4				5
42C	Jefferson			2		2					4 (1)
43C	Canton Ag. & Tech.	1		1		1	1				4
44C	Mater Dei, Ogdensburg										0
45C	Delhi Ag. & Tech.				2		3				5
46C	Broome					1	3				4
47C	Morrisville, Ag.&Tech.		1	1		11	1				4 (1)
48C	Genesee						1				1 (2)
49C	Hilbert										0 (1)
50C	Trocaire College										0
51C	Erie			1		1	1				3
52C	Saint Clare										0
53C	Villa Maria, Buffalo		2			0			1		3
54C	Niagara			1		2	2				5
55C	Finger Lakes			1							1 (1)
56C	Monroe	1					2				3 (1)
57C	Jamestown						2				2
58C	Alfred Ag. & Tech.	1				1	1				3 (1)
59C	Corning										0
	Totals	5	7	18	4	31	42	4	1	1	113

Results from Post-Secondary Teachers:

It should be noted that the college teachers had a great degree of difficulty in responding to question number 3, i.e., indicating their occupational area of instruction from the choices listed on the form. Evidently, the instrument was not as adaptable to the post-secondary population as originally thought. Several of the forms were answered by Liberal Arts instructors and were therefore disqualified.

Many of the engineering instructors noted their area of instruction as being 'trade and industrial." All engineering instructors who checked "other" were tabulated under the T & I column and food service instructors were counted under the home economics occupations listing. The latter decision was arrived at after consultation with Department personnel associated with the occupational field.*

The majority (64.6%) of college teachers that responded were from the health occupations (27.4%) and trade and industrial (37.2%) areas of instruction. Home economics and agricultural education teachers have the smallest representation in the sample.

A little more than two-thirds of the respondents were engaged in teaching college courses (health and T & I) in which metric measurement has routinely or increasingly been employed, and so it was not unusual to find 55 percent of the 110 respondents to question #4 indicating affirmatively that their students routinely use the metric system. Approximately half of the teachers who do not have students that routinely use the metric system attempt to stimulate an "awareness" of the metric concept.

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* Rationale: If the majority of the engineering instructors considered their main occupational area to be T & I, it seemed logical to place all engineering teachers in this category.

Three respondents noted "food services - nutrition care." State experts agreed that had the respondents noted "food trades" the proper category would have been T & I but since "services" was noted, home economics was the proper categorization.

The college instructors did rank the sources they considered most influential in encouraging teachers to have students "think metric." Forty-three of the respondents noted that "no source" encouraged them to teach the concept. The category entitled "related Professional organizations through journals, etc." was selected as the primary influence by 32 teachers; "business or industry leaders" was the secondary influence; and no discreet tertiary influence was discernible.

One hundred eight teachers responded to the question seeking information regarding in-service metric measurement workshops. Eighty-two, or 75.9 percent, of these noted that workshops have not been considered. Two instructors, both from the same institution, indicated that a workshop had been held; 13 others said they are planned. Eleven additional teachers checked the "other" category and noted attendance at conference workshops.

An overwhelming majority, 72 of the 109 teachers who responded to item #10, felt that emphasis now needs to be placed on teaching the metric system in their particular instructional area. When asked if "... you presently feel a need or desire to participate in a workshop on the metric system", 53 of 104 were affirmative.

Discussion:

Though the percentage of health occupation educators and trade and industrial teachers in both the secondary and post-secondary groups was within a comparable range, the percentages responding that their students regularly used the metric system were not. More than half of the post-secondary instructors responded affirmatively compared to 18 percent of the high school teachers.

Both groups of teachers indicated that:

a. in a majority of cases the instructors do attempt to stimulate "awareness" of the metric system.

b. the primary source of influence to stimulate student understanding of the metric system was generated by related professional organizations.

c. metric measurement workshops had not been considered in most schools and relatively few are planned.

d. they felt that emphasis on teaching the metric system in their area of instruction is needed.

e. a need (or desire) to participate in a workshop concerning the metric system exists. The need was expressed by approximately three-quarters of the high school teachers and half of the college teachers.

The final item on the questionnaire allowed the respondents to express their ideas, feelings or comments regarding the metric system and education. Approximately one-half of the teachers made some type of comment. The majority of both the high school and post-secondary instructors responding to this question restated a need for "teacher methods" and "applications specific to field." The total group was represented almost evenly by those that thought the metric system "should be taught now or already" and those that said "wait for the law mandate or change when really needed." More of the post-secondary instructors held the latter view. A few teachers felt that the process should be a "gradual phasing of the metric system into the curriculum."

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A few others felt that an emphasis on all math was needed; that metrication should be taught at the grammer school level. Several questioned the "real need for metrics"; others voiced a concern in teaching the system to slow learners.

Some of the respondents offered their services in attempting to set up metric in-service workshops. The general sentiment of the respondents seemed to be one of cooperation in moving toward metrics although a need for guidance and leadership was highlighted.

Many of the instructors requested resource information and reference materials. It was therefore, decided to include in this publication several bibliographical references taken from multiple sources. It was thought that these references may act as a temporary aide to instructors until a more concrete form of action can be implemented by the Education Department personnel.

Recommendations:

It is strongly recommended that metric measurement teaching techniques specific to the occupational education areas be developed and packaged into a hands-on in-service workshop experience. This workshop should be of a practical nature, be no longer than a half-day school session, be staffed by Education Department personnel, and be held at various regions throughout the State that are readily accessible to clusters of teachers. The planning of such workshops should include local resource people so that pre-and post-workshop relationships can be established at the community level.

It is recommended that guidelines regarding metrication be established and endorsed by the Department.

It is also recommended that Department personnel study the experimental metric projects presently being conducted in New York State and disseminate the findings through Department publications. Specific personnel should be assigned to study metric provisos in Federal legislation and publicize the affect this legislation may have on metric education in New York State.

METRIC RESOURCES

SELECTED METRIC PUBLICATIONS

Metric News. Published six times during the year by Swani Publishing Company, P.O. Box 248, Boscoe, Illinois 61073. ($5 for six issues or $1 single copy.)

School Shop. Special feature: Metrics in Industrial-Technical Education (25 separate articles), Volume XXXIII, No. 8, April 1974.

METRIC INFORMATION RESOURCES

American National Metric Council
1625 Massachusetts Avenue, NW
Washington, DC 20036

American National Standards Institute, Inc.
1430 Broadway
New York, NY 10018

Metric Association, Inc.
Sugarloaf Star Route
Boulder, CO 80302

Metric Information Office
National Bureau of Standards
Washington, DC 20234

The National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091
ATTN: Joseph R. Caravella
Metric Implementation Committee

The Center for Metric Education
Western Michigan University
Kalamazoo, MI 49003
ATTN: Dr. John L. Feirer
Project Director
Metrication of Technical Career Education

TRADE AND TECHNICAL ASSOCIATIONS

Air Conditioning and Refrigeration Institute
1815 North Fort Myer Drive
Arlington, VA 22209

American Paper Institute
260 Madison Avenue
New York, NY 10016

American Society for Abrasive Methods
1049 South Main Street
Plymouth, MI 48170

The American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

American Society for Metals
Metals Park, OH 44073

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

American Welding Society
2501 Northwest 7th Street
Miami, FL 33125

Illuminating Engineering Society
345 East 47th Street
New York, NY 10017

Industrial Fasteners Institute
1717 South 9th Street
1505 East Ohio Bldg.
Cleveland, OH 44114

Institute of Electrical and Electronic Engineers
345 East 47th Street
New York, NY 10017

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National Association of Manufacturers
277 Park Avenue
New York, New York 10017

National Fluid Power Association
P.O. Box 49
Thiensville, WI 53092

National Forest Products Associaton
1619 Massachusetts Avenue, NW
Washington, D.C. 20036

National Microfilm Association
8728 Colesville Road
Suite 1101
Silver Springs, Md. 20910

National Tool, Die & Precision
Machining Association
9300 Livingston Road
Washington, D.C. 20022

Society of Automotive Engineers
Two Pennsylvania Plaza
New York, N.Y. 10001

Steel Plate Fabricators Association
15 Spinning Wheel Road
Hinsdale, Ill. 60521

SELECTED METRIC MEASUREMENT ERIC DOCUMENTS

ED #	Title	Date
055 890	U.S. Metric Study Interim Report-Education	July 1971
070 842	" " " " " -The Consumer	July 1971
070 833	" " " " " -International Trade	July 1971
069 883	" " " " " -Engineering Standards	July 1971
054 955	The Use of SI Units	January 1969
068 330	A History and Overview of Metrication and Its Impact on Education	1972
072 306	Metrication: A Guide for Producers of Packaged Goods	1972
075 683	Metrication: A Guide for Consumers	1972
073 230	Going Metric: Looking Ahead	1972